

## IRRIGATION AUTOMATION USING RESISTIVE SOIL MOISTURE SENSOR

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### ABSTRACT

*Irrigation by help of freshwater resources in agricultural areas has a crucial importance. Because of highly increasing demand for freshwater, optimal usage of water resources has been provided with greater extent by automation technology and its apparatus such as solar power, drip irrigation, sensors and remote control. The resistive type of moisture sensor is made up of two electrode probes to pass current through the soil, and then we read that resistance to get the moisture level. More water makes the soil conduct electricity easily (less resistance), while dry soil conducts electricity poorly (more resistance). When the soil is dry condition the sensor measures the resistance and converts into volts. Soil moisture sensor and relay actuates the solenoid valve. If solenoid valve open, the pump is ON then the flow will take place by automatic water controller pump. While the soil is wet condition, the solenoid valve closes. At the same time automatic water controller pump is stop due to high pressure of water flow then the pump is automatically OFF position. In present days, especially farmers are facing major problems in watering their agriculture fields, it's because they have no proper idea of when the power is available so that they can pump water. Even after then they need to wait until the field is properly watered, which makes them stop doing other activities. Here is an idea that helps not only farmers even for watering the gardens also, which senses the soil moisture and switches the pump automatically when the power is ON. Automatic Irrigation System is very useful to the farmers.*

**KEYWORDS:** Irrigation, Resistive Soil Moisture Sensor, Solenoid Valve, Automatic Water Controller Pump & Arduino

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### I. INTRODUCTION

India is the agriculture based country. Our ancient people completely depended on the agricultural harvesting. Agriculture is a source of livelihood of majority Indians and great impact on the economics of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So, its need to be automated for proper yield and handled remotely for farmer safety. Increasing energy costs and decreasing water supplies point out the need for better water management. Irrigation management is a complex decision-making process to determine when and how much water to apply to a growing crop to meet specific management objectives. If the farmer is far from agricultural land he will not be noticed of current condition. So, efficient water management plays an important role in the irrigated agricultural cropping system. A low cost alternative solution for efficient water management currently in use is drip irrigation system that consists of an automated controller to turn on and off the control valve, which in-turn helps the farmers by managing the water supply to the crop fields and further maintains the moisture level of soil.

This paper gives a review of irrigation automation using resistive soil moisture sensor. Arduino and monitoring system with automatic irrigation management is proposed in this project. The rest of the paper is organized as follows. Section II analysis the objective of the automatic irrigation system. Section III describes the

basic need of the project. Section IV describes the proposed system. Section V presents methodology and components used in the system. Section VI the working principle of the system. Finally, Section VII deals with conclusion and the last is the reference paper.

## II. OBJECTIVE

The main objective of the research is to develop and to test an automatic system having a low cost sensor for an irrigation system.

Irrigation system uses valves to turn irrigation ON or OFF. These valves may be easily automated by using controller and solenoids. In this research an attempt has been made to automatic farm or nursery irrigation that allows farmers to apply the right amount of water at the right time, regardless of availability of labour to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of the day, which will improve crop performance by ensuring adequate water and nutrients when needed.

## III. NEED OF THE PROJECT

In India, the market is mainly based on agriculture and the climatic environment is isotropic and is not able to make full use of agricultural assets. The main cause is the lack of rains in many part of India and scarcity of land water. The demand for new water saving technique in irrigation is growing immediately right now. At the present period, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the normal interval. This process sometimes consumes additional water or sometimes the water reaches delayed due to which the crops get dehydrated.

## IV. PROPOSED SYSTEM

The system is a sustainable solution to enhance water use efficiency (WUE) in the agricultural fields. It provides water for plants according to the crop water requirement and operates according to the soil moisture condition of the root zone of plants. Thus it reduces excessive pressure on farmers to pay additional water tariff on water. In addition pump water irrigation also save additional cost for water pumping.

Further, automated irrigation system allows farmers to apply the right amount of water at the right time. Besides human attention was reduced on irrigation significantly, moreover energy consumption on water pumps could be required by efficient water allocation based on the crop water requirement.

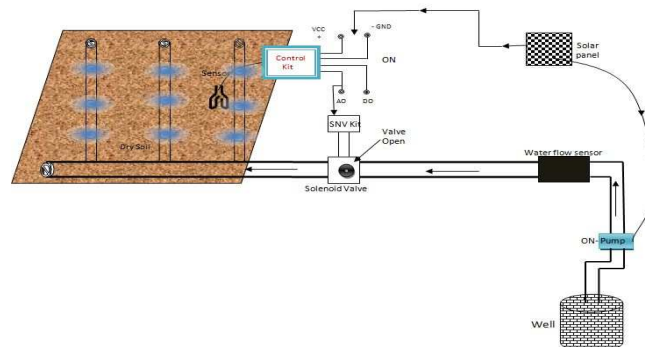


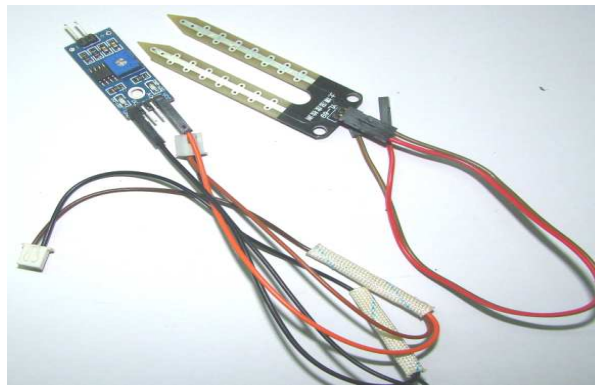
Figure 1: Overview of System Installed in the Area

## V. METHODOLOGY AND COMPONENTS

The main hypothesis in regards to this work is that using sensor technology to automate irrigation in which it improves water usage efficiency. This is due to the fact that the sensors could provide information about the water content of the environment to an irrigation controller, and preset watering of plants could be arranged to suit current condition.

- **Resistive Soil Moisture Sensor**

The resistive type of moisture sensor is made up of two electrode probes to pass current through the soil, and then we read that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity more poorly (more resistance). A current is passed across the electrodes through the soil and the resistance to the current in the soil determines the soil moisture. This Sensor has both digital and analogue outputs. Digital output is simple to use but is not as accurate as the analogue output.



**Figure 2: Resistive Soil Moisture Sensor**

**Table 1: Features of Resistive Soil Moisture Sensor**

Working Voltage	5V
Working Current	20ma
Interface	Analog
Depth of deduction	37mm
Working Temperature	10 <sup>0</sup> C – 30 <sup>0</sup> C
Weight	3g
Size	63 x 20 x 8 mm
Software	Ardino Compatible Interface
Output Voltage Signal	0 – 4.2 V
Sensitivity	High
Power consumption	Low

- **Relay**

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit.

All relays contain a sensing unit, the electric coil, which is powered by AC or DC current. When the applied current or voltage exceeds a threshold value, the coil activates the armature, which operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that actuates the switch mechanism. The magnetic force is, in effect, relaying the action from one circuit to another. The first circuit is called the control circuit and the second is called the load circuit.

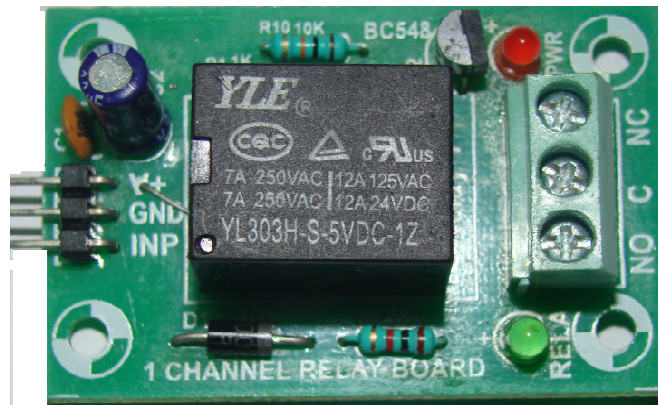


Figure 3: Relay

- **Solenoid Valve**

The medium flows through a small orifice which can be closed off by a plunger with a rubber gasket on the bottom. A small spring holds the plunger down to close the valve. The plunger is made of a ferromagnetic material. An electric coil is positioned around the plunger. As soon as the coil is electrical energized, a magnetic field is created which pulls the plunger up towards the centre of the coil. This opens the orifice so that the medium can flow through. This is called a Normally Closed (NC) valve. A Normally Open (NO) valve works the opposite way: it has a different construction so that the orifice is open when the solenoid is not powered. When the solenoid is actuated, the orifice will be closed.

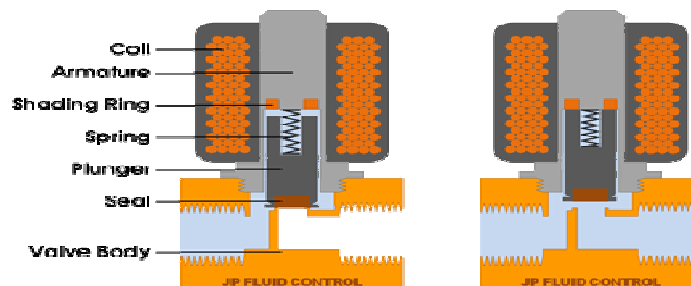


Figure 4: Working Principle of Solenoid Valve

- **Automatic Controller Water Pump**

It is designed to maintain constant pressure. It does not permit the pump to operate without water and avoids water hammering. It requires no preloading of air or adjustment. It has a water reserve to prevent the unit from being started by a dripping tap. If water consumption is more than 1l/m, the pump will operate continuously. When the pump reaches the maximum pressure the unit automatically switches the pump off. Unit selection must take into account the fact the differential must be over 0.7 bar

Table 2: Features of Automatic Water Controller Pump

Input Voltage	220-240v
Frequency	50/60hz
Max Current	10a
Protection Rating	Ip65
Max Working Pressure	10 Bar
Max. Temp	60 °C
Size	24 X 14 X 13 Cm



Figure 5: Automatic Water Controller Pump

- **Self Priming Pump**

The term "self-priming pump" describes a centrifugal pump that can use an air-water mixture to reach a fully-primed pumping condition.

- **Arduino**

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino projects can be stand-alone or they can communicate with software running on a computer. The boards can be built by hand or purchased pre assembled; the software can be downloaded for free.

#### Programming Language

```
void setup() {
  Serial.begin(9600);
}
void loop() {
  if(analogRead(5) < 300) {
    Serial.println("I am thirsty ,please give me water");
  }
  if(analogRead(5) > 300 && analogRead(5) < 700) {
    Serial.println("I feel so comfortable");
  }
  if(analogRead(5) > 700) {
    Serial.println("Too much water, I might get hurt");
  }
  delay(200);
}
```

## V. WORKING PRINCIPLE OF THE SYSTEM

A system is proposed for automatic irrigation system based on soil moisture requirement. This system uses three nodes which communicate each other and irrigate agricultural field automatically. The system consist of soil moisture sensor to detect the moisture level and automatically irrigate the field by means of solenoid valve to control the flow of water from source to field and pressure sensor to control the power supply to water pump. The obtained irrigation system

not only prevents the moisture stress on crops, but also provides an efficient use of water resource. The proposed technique can help in automatic ON/OFF the motor by using soil moisture sensors at fields and also in gardens which avoid the need of a human being.

## VI. CONCLUSIONS

In present days, especially farmers are facing major problems in watering their agriculture fields, it's because they have no proper idea of when the power is available so that they can pump water. Even after then they need to wait until the field is properly watered, which makes them stop doing other activities. Here is an idea that helps not only farmers even for watering the gardens also, which senses the soil moisture and switches the pump automatically when the power is ON. Automatic Irrigation system is very useful to farmers.

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